Fermi National Accelerator Laboratory
Batavia, IL 60510

CMS ME3/1 CHAMBER ELECTRICAL TEST HIGH VOLTAGE TEST AND TRAINING TRAVELER

Reference Drawing(s)
Endcap Muon Chamber ME3/1 Final Assembly 5520-ME-368310

Endcap Muon Chamber Anode Panel Assembly 5520-ME-368254

Budget Code:	**Project Code:**
Released by:	**Date:**

Prepared by: M. Hubbard, B. Jensen, L. Lee

Title	Signature	Date
TD / E&F Process Engineering	**Bob Jensen/Designee**	
TD / E&F CMS Assembly	**Glenn Smith/Designee**	
TD / E&F Technological Physicist	**Oleg Prokofiev/Designee**	
TD / CMS Project Manager	**Giorgio Apollinari/Designee**	

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	04/26/00

Ensure appropriate memos and specific instructions are placed with the traveler before issuing the sub traveler binder to production.

1.0 General Notes

1.1 White (Lint Free) Gloves (Fermi stock 2250-1800) or Nitrile Gloves (Fermi stock 2250-2040) shall be worn by all personnel when handling all product parts after the parts have been prepared/cleaned.

1.2 All steps that require a sign-off shall include the Technician/Inspectors first initial and full last name.

1.3 No erasures or white out will be permitted to any documentation. All incorrectly entered data shall be corrected by placing a single line through the error, initial and date the error before adding the correct data.

1.4 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.

1.5 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.

1.6 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.

1.7 Cover the panel/chamber with Mylar when not being serviced or assembled.

1.8 Never hand/ pass anything over a panel, damage could occur.

2.0 Parts Kit List

2.1 Attach the completed Parts Kit List for the CMS Chamber Test and Training to this traveler. Ensure that the serial number on the Parts Kit List matches the serial number of this traveler. Verify that the Parts Kit received is complete.

_____ _____

Process Engineering/Designee Date

3.0 Chamber Electrical Test Preparation

Completed

3.1 Put chamber on Chamber transportation cart, fix Chamber in the vertical position and move to the Chamber Electrical Test Stand. ❒

3.2 Acquire the Chamber (ME-368310) as per the Chamber Serial Number at the bottom of this traveler ❒

3.3 Transfer and fix chamber to the Test Stand. Remove Chamber Transportation Cart. ❒

Technician(s) Date

4.0 Chamber Gas Mixture Setting

4.1 Select gas mixture setup (line) on the gas distribution rack corresponding to the Test Stand with the Chamber mounted on it. ❒

4.2 Slowly open three 2-way gas selection valves to bring Argon, Carbon Dioxide and Freon 14 to the corresponding rotameters. ❒

4.3 Check flow rate of rotameters and set if it is needed to desired flow rates. ❒

Note(s):

Be sure that rotameter reading at ball center is in the range ∓ 1/8" of marked position.

4.4 Connect gas mixture manifold to the chamber inlet and connect chamber outlet to the Bubbler. Bubbles will pass through Bubblers. ❒

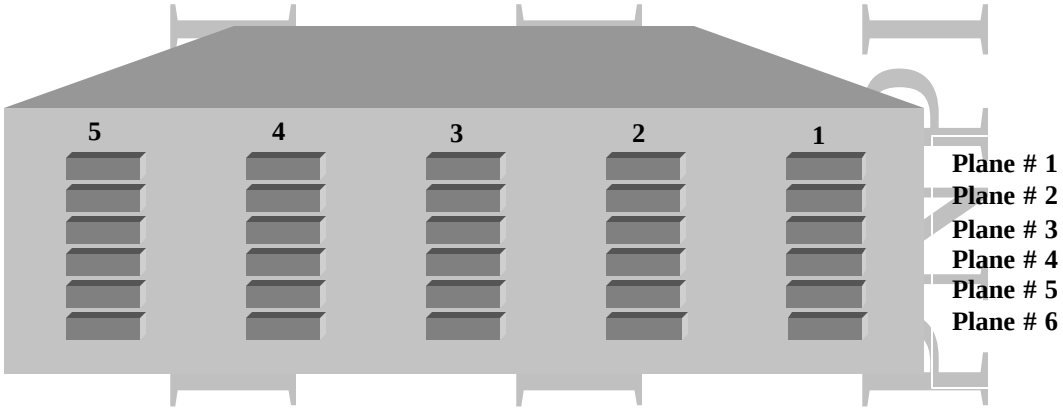
4.5 Record date/time the gas mixture purge started through the Chamber ❒

	Date	Time
Gas Mixture Purge Start		

Technician(s) Date

5.0 Cathode Strip Resistance tests

5.1 Using a Multimeter, and a Toggle Switch Box, check the continuity in resistance of the cathode strip connectors. In accordance with the drawing, test each connector and if it passes, check it off in the chart below. If it fails, write the resistance value in the "Fail" box.



Note(s):

All measurements must be within the range of 0.9 – 1.1 Meg Ohm.

	5		4		3		2		1	
	Pass	**Fail**	**Pass**	**Fail**	**Pass**	**Fail**	**Pass**	**Fail**	**Pass**	**Fail**
Plane #1										
Plane #2										
Plane #3										
Plane #4										
Plane #5										
Plane #6										

Remarks:_____

Note(s):

After measurements are completed inform supervisor of any failures.
If all pass continue.

_____ _____

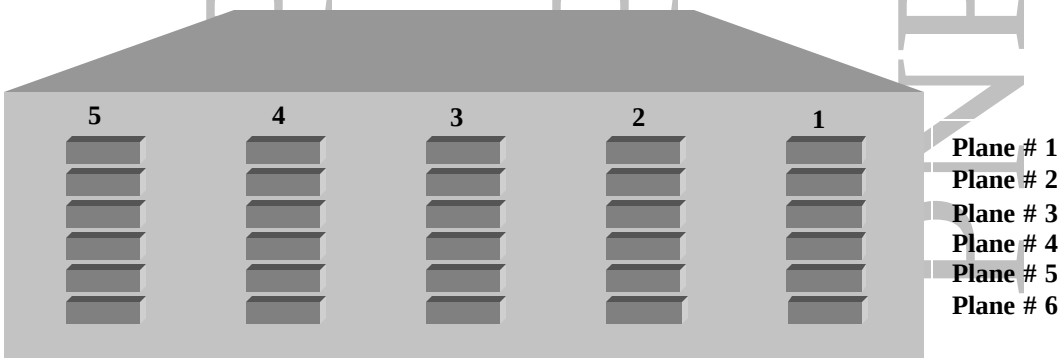
Technician(s) Date

6.0 Inter-strip Cathode Strip Capacitance Measurements

6.1 Using Capacitance Measuring Unit measure Inter-strip Cathode capacitance from the Strips. Record data file and print data. Enclose data in the traveler.

Note(s):

After measurements are completed inform supervisor of any discrepancy with reference data table (plot) the capacitance measurements.



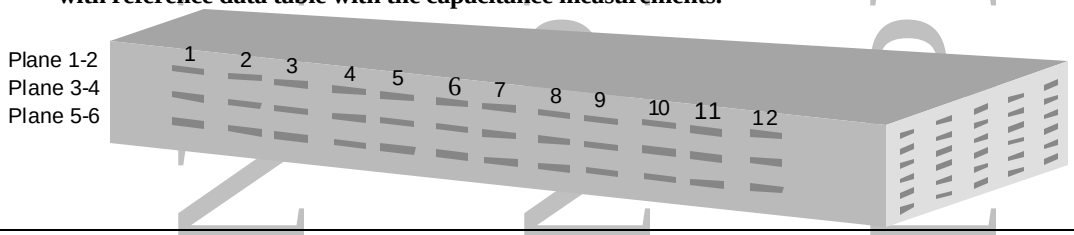
Technician(s) _____ Date _____

7.0 Anode wire group capacitance measurements

7.1 Using a Capacitance Measuring Unit (LCR Meter), measure the anode wire group capacitance from the protection boards. Measuring will be start from the narrow side of panel.

Note(s):

After measurements are completed inform supervisor of any discrepancy with reference data table with the capacitance measurements.



Plane 1-2												
		Protection Board										
		1	2	3	4	5	6	7	8	9	10	11	12
CHANNEL NUMBER	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
Range: LOW? HIGH													

Remarks: _____

_____

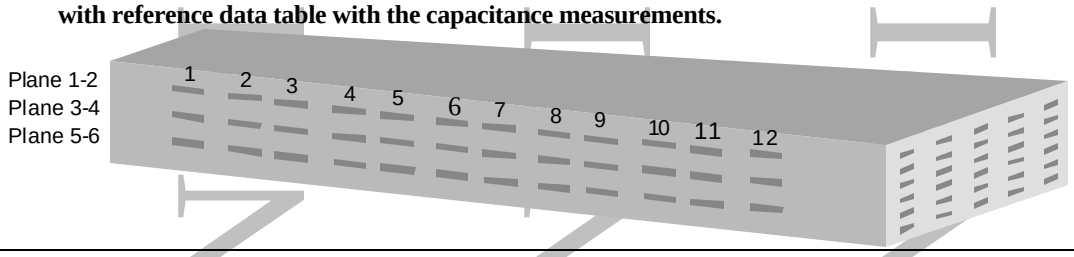
_____ _____

Technician(s) Date

7.2 Using a Capacitance Measuring Unit (LCR Meter), measure the anode wire group capacitance from the protection boards. Measuring will be start from the narrow side of panel.

Note(s):

After measurements are completed inform supervisor of any discrepancy with reference data table with the capacitance measurements.



Plane 3-4												
		Protection Board										
		1	2	3	4	5	6	7	8	9	10	11	12
CHANNEL NUMBER	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
Range: LOW? HIGH													

Remarks: _____

_____

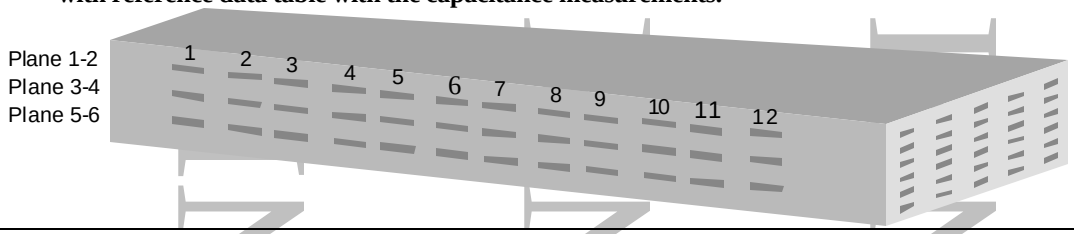
_____ _____

Technician(s) Date

7.3 Using a Capacitance Measuring Unit (LCR Meter), measure the anode wire group capacitance from the protection boards. Measuring will be start from the narrow side of panel.

Note(s):

After measurements are completed inform supervisor of any discrepancy with reference data table with the capacitance measurements.



Plane 5-6													
		Protection Board											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CHANNEL NUMBER	**1**												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
Range: LOW? HIGH													

Remarks: _____

_____

_____ _____

Technician(s) Date

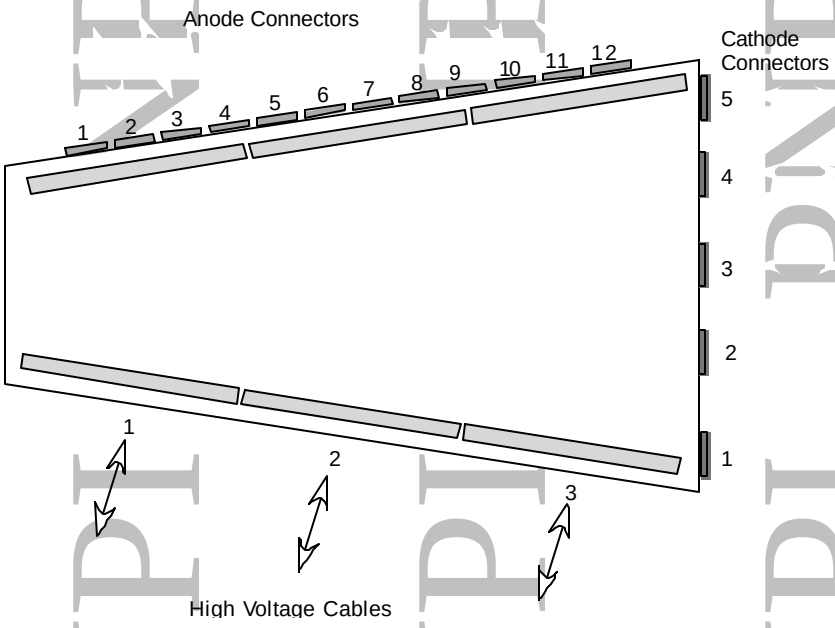
8.0 Chamber High voltage test.

Completed

Note(s):

Be sure that before starting High Voltage tests the chamber was purged with working gas mixture at least 24 hours.

8.1 Connect chamber to the High Voltage power supply. ❒



8.2 Raise slowly High Voltage up to 4.0 kV (15 minutes per voltage step).
Record current data from the chamber to the table.

HV kV	I mA	Time	I mA	Time	I mA	Time	I mA	Remark
1.0								
2.0								
3.0								
3.2								
3.4								
3.6								
3.7								
3.8								
3.9								
4.0								

Note(s):

In case of corona or high current more than 5.0 mA per plane:
specify and disconnect High Voltage Segment
continue raise High Voltage in accordance with procedure

8.3 Set HV = 3.6kV and measure current from each segment.
Record current in the table.

Plane #	Plane Current (mA)	Segment Current (mA)				
		1	2	3	4	5
1						
2						
3						
4						
5						
6						

8.4 Set HV = 4.0kV and measure current from each segment.
Record current in the table.

Plane #	Plane Current (mA)	Segment Current (mA)				
		1	2	3	4	5
1						
2						
3						
4						
5						
6						

Technician(s) Date

9.0 Chamber High Voltage Training With Reverse Polarity

Completed

9.1 Connect chamber to the High Voltage power supply with reverse polarity. ❒

9.2 Raise slowly High Voltage up to 3.3 kV (up to 10 minutes per voltage step). ❒
Current must be less than 20-30 μA.
Record current data from the chamber to the table.

Note(s):
Don't keep Chamber under reverse High Voltage more than 30 minutes.

Reverse Polarity Test #1

HV kV	I mA	Time	I mA	Time	I mA	Time	I mA
2.4							
2.5							
2.6							
2.7							
2.8							
2.9							
3.0							
3.1							
3.2							
3.3							

Remarks:_____

_____

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_____

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_____ _____

Technician(s) Date

Completed

9.3 Perform 2nd Reverse Polarity test ONLY if discrepancies occurred in step 10.3. ❒

9.4 Connect chamber to the High Voltage power supply with reverse polarity. ❒

9.5 Raise slowly High Voltage up to 3.3 kV (up to 10 minutes per voltage step). ❒
Current must be less than 20-30 μA.
Record current data from the chamber to the table.

Note(s):

Don't keep Chamber under reverse High Voltage more than 30 minutes.

Reverse Polarity Test #2

HV kV	I mA	Time	I mA	Time	I mA	Time	I mA
2.4							
2.5							
2.6							
2.7							
2.8							
2.9							
3.0							
3.1							
3.2							
3.3							

Remarks:_____

_____

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_____

_____ _____

Technician(s) Date

9.6 Measure current at 3.3 kV from each segment.
Record date to the table.

Plane #	Plane Current (mA)	Segment Current (mA)				
		1	2	3	4	5
1						
2						
3						
4						
5						
6						

Technician(s) Date

10.0 Chamber High voltage training with normal polarity.

Completed

10.1 Connect chamber to the High Voltage power supply with normal polarity. ❒

10.2 Raise slowly High Voltage up to 3.5-3.6 kV. ❒
Current will be less than 5.0 μA per plane.

10.3 Start training procedure. Keep chamber under high voltage 1-2 days till current drop to 1 μA or less per plane. Increase High Voltage for 0.1kV and continue chamber training. ❒
Record current data from the chamber to the table.

	Chamber All Panels	**Time**		**Plane #**					
				1	**2**	**3**	**4**	**5**	**6**
HV kV	**I μA**	**Start/ Stop**	**Date**	**I μA**	**I μA**	**I μA**	**I μA**	**I μA**	**I μA**

Remarks:_____

_____

_____

_____

_____ _____

Technician(s) Date

10.4 Raise slowly High Voltage to 4.0 kV. Keep chamber under this voltage at least 24 hours. Record data into table.

	Chamber All Panels	Time		Plane #					
				1	2	3	4	5	6
HV kV	I µA	Start/ Stop	Date	I µA	I µA	I µA	I µA	I µA	I µA
4.0									
4.0									
4.0									
4.0									
4.0									
4.0									
4.0									
4.0									
4.0									
4.0									

Note(s):

Criterion of the good chamber:

-Current less than 1.0mA per plane for 24 hours.

-No current trip at 10mA trip set for 24 hours.

Technician(s) Date

11.0 Chamber Cosmic Test

Completed

11.1 Connect amplifier to the protection board. ❒

11.2 Check anode signals from all anode protection boards. ❒

Note(s):

After measurements are completed inform supervisor of any missing signals from anode protection boards.

Technician(s) Date

12.0 Production Complete

XXX 12.1 Process Engineering verify that the Electrical Test / HV Test and Training (5520-TR-333470) is accurate and complete. This shall include a review of all steps to ensure that all operations have been completed and signed off. Ensure that all Discrepancy Reports, Nonconformance Reports, Repair/Rework Forms, Deviation Index and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

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_____

_____

_____ _____

Process Engineering/Designee Date

13.0 Attach the Process Engineering "OK to Proceed" Tag on the panel.

_____ _____

Process Engineering/Designee Date

14.0 Proceed to the next major assembly operation as required.